**Motivation: -**

The main motive of using this system is to prevent the loss of life or any other damage to the companies, organizations and other indoor environments. The fire detection system is used to detect fire in the air through sensors in a real time monitoring system based on Raspberry Pi. The main feature of system is to alert and generate notification when fire is started or reached it minimum level to prevent from the loss of lives and damages of any other property, taking into the account, life and valuable things that are useful for the company or any place where it is installed.

**Problem Statement: -**

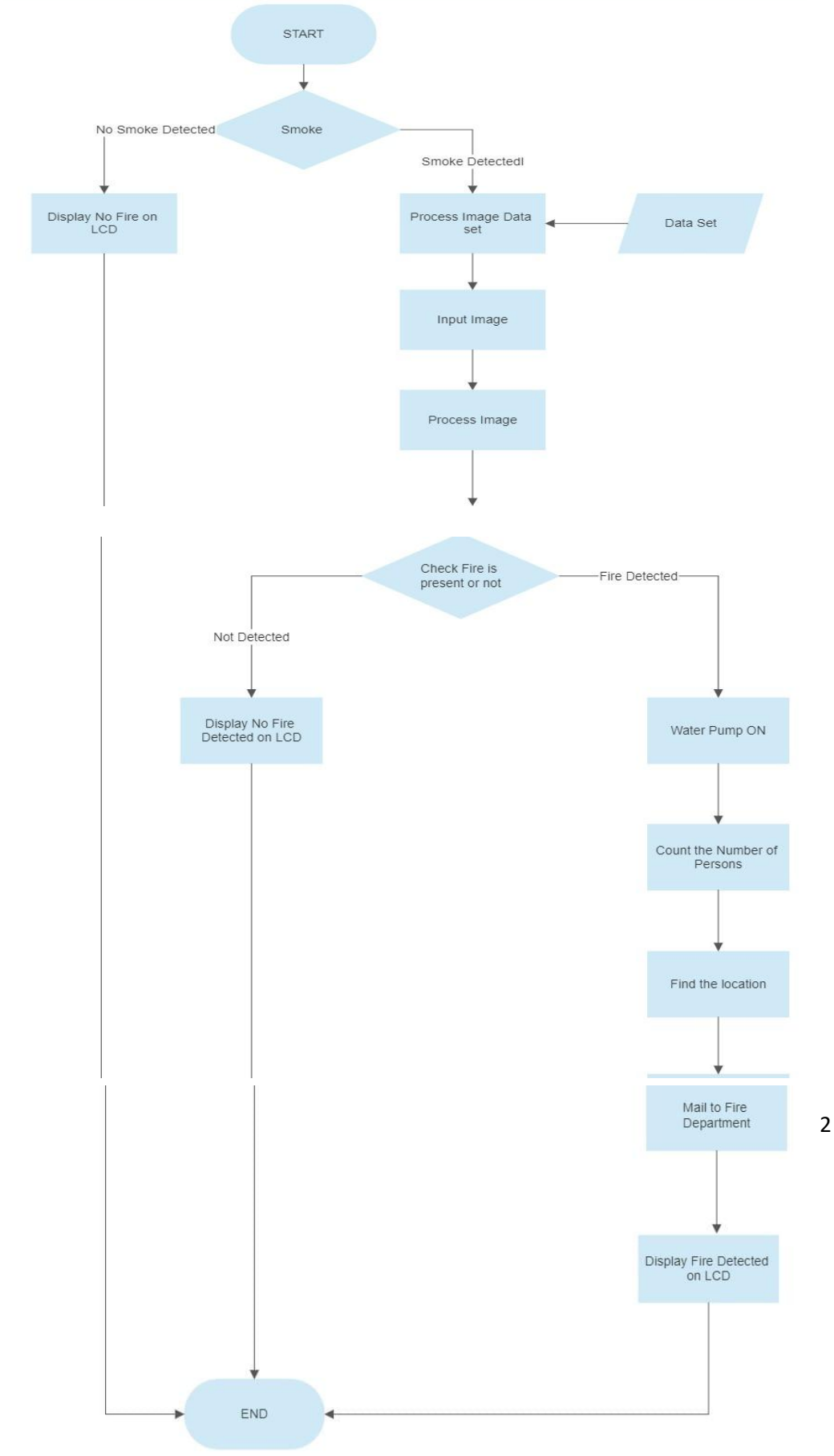
The objective of our project was to design and implement a fire detection system that addresses the limitations of traditional smoke sensors by incorporating machine learning. The following design specifications were identified at the outset of the project:

- Develop a system that can accurately detect the presence of fire.
- Estimate the size or extent of the fire to provide insights into its intensity.
- Utilize image processing techniques to analyze real-time images captured by a webcam.
- Implement machine learning algorithms to classify fire and non-fire scenarios.
- Integrate hardware components such as a Raspberry Pi, LCD screen, relay, and PCB for enhanced functionality.
- Control a water pump using a relay for immediate fire suppression actions.

**Design Procedure: -**

The design procedure for our fire detection system involved careful selection of hardware components, creation of a machine learning model, integration of hardware and software, and extensive testing and troubleshooting.

We selected the MQ22 smoke sensor, webcam, Raspberry Pi, LCD screen, relay, and PCB for their compatibility and functionality requirements. we researched and implemented algorithms for fire localization and size estimation based on real-time images captured by the webcam. In parallel, we collected a labeled dataset of fire and non-fire images for training the machine learning model, which utilized convolutional neural networks (CNNs). The hardware components were then integrated with the software modules, and thorough testing was performed to ensure proper functionality and reliability.

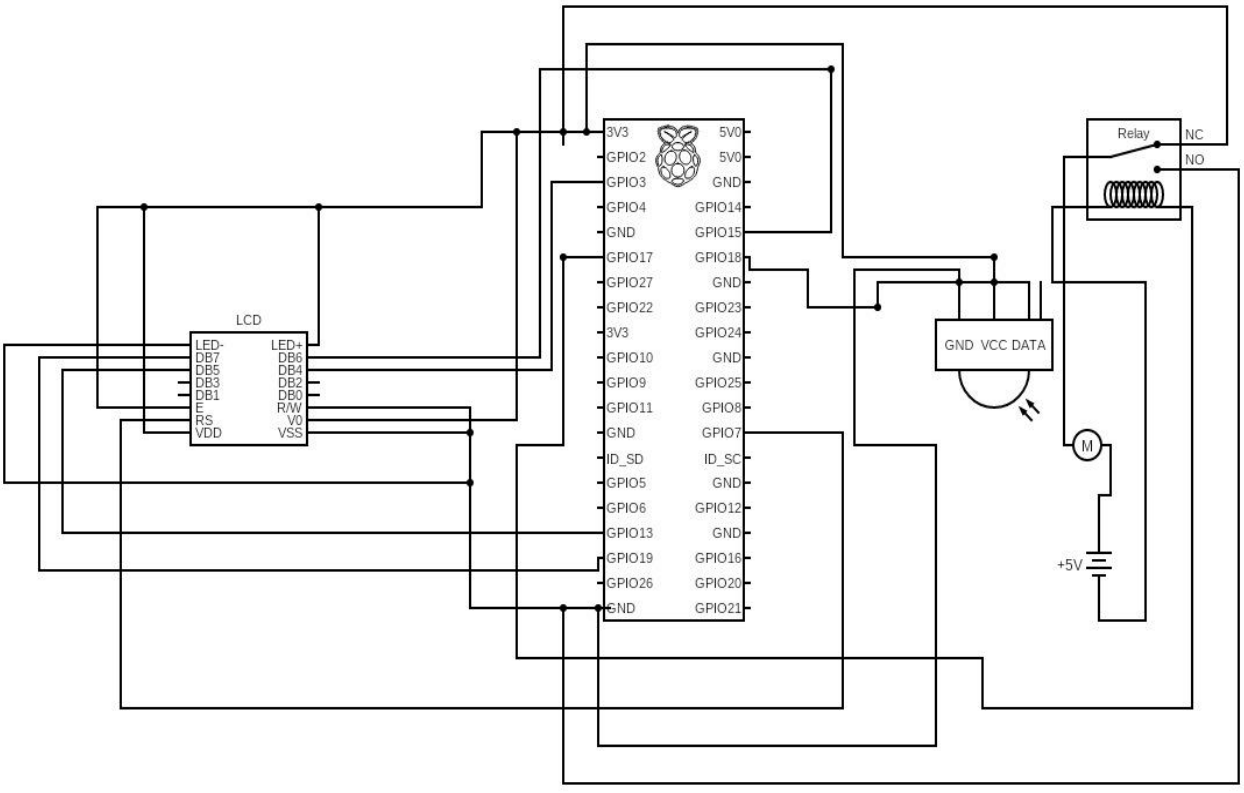

START
Smoke
No Smoke Detected
Smoke Detectedl
Display No Fire on LCD
Process Image Data set
Data Set
Input Image
Process Image
Check Fire is present or not
Fire Detected
Not Detected
Display No Fire Detected on LCD
Water Pump ON
Count the Number of Persons
Find the location
Mail to Fire Department
Display Fire Detected on LCD
END

**Budget: -**

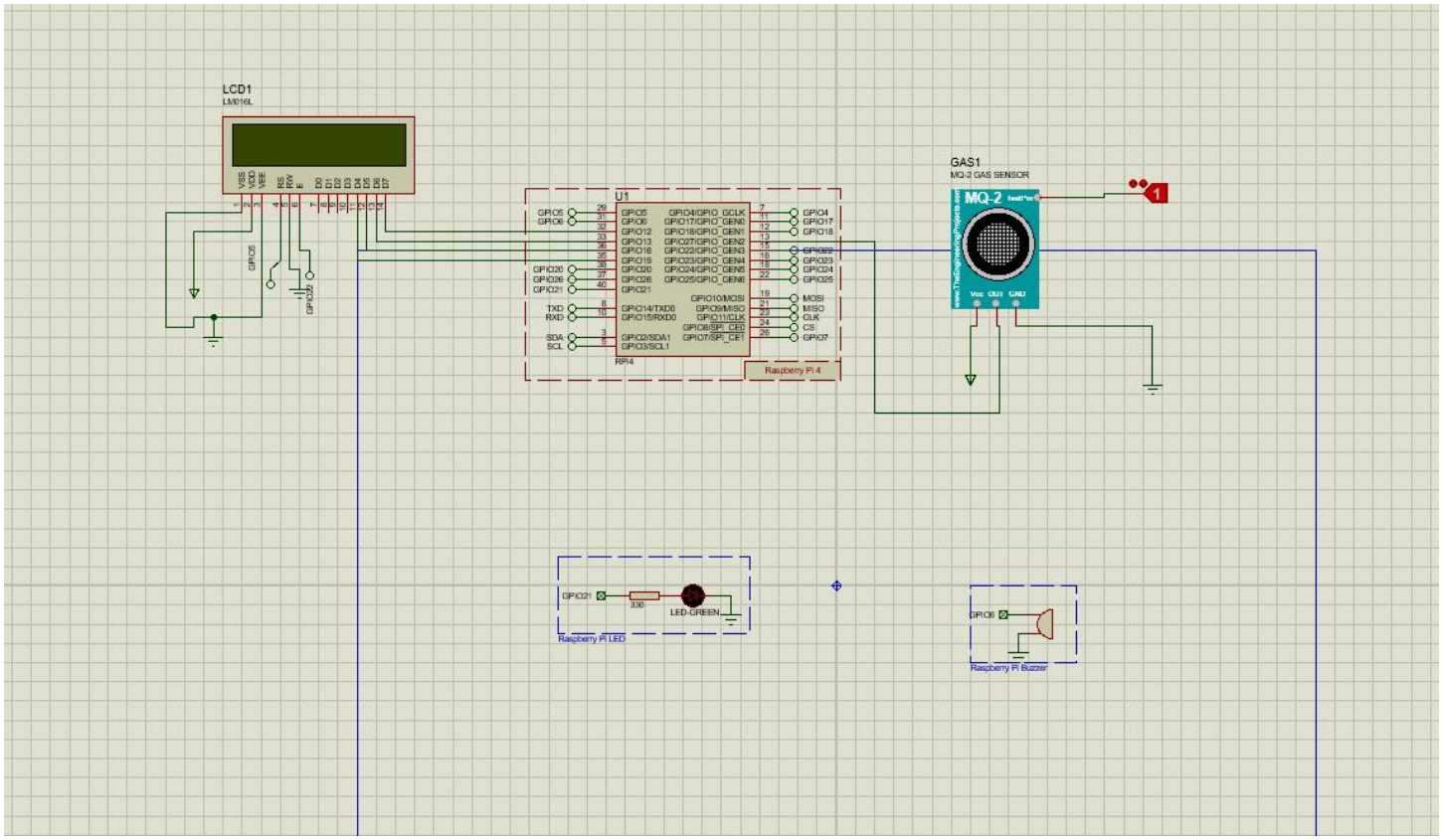
The budget for our project includes the cost of various components and boards required:

| SNO | COMPONENTS | PRICE |
|---|---|---|
| 1 | MQ22 smoke sensor: | 99/- |
| 2 | Webcam | 1099/- |
| 3 | Raspberry Pi | 3864/- |
| 4 | LCD screen | 261/- |
| 5 | Relay | 161/- |
| 6 | total | 5483/- |

**Circuit Diagram / Board Layout / Schematic: -**

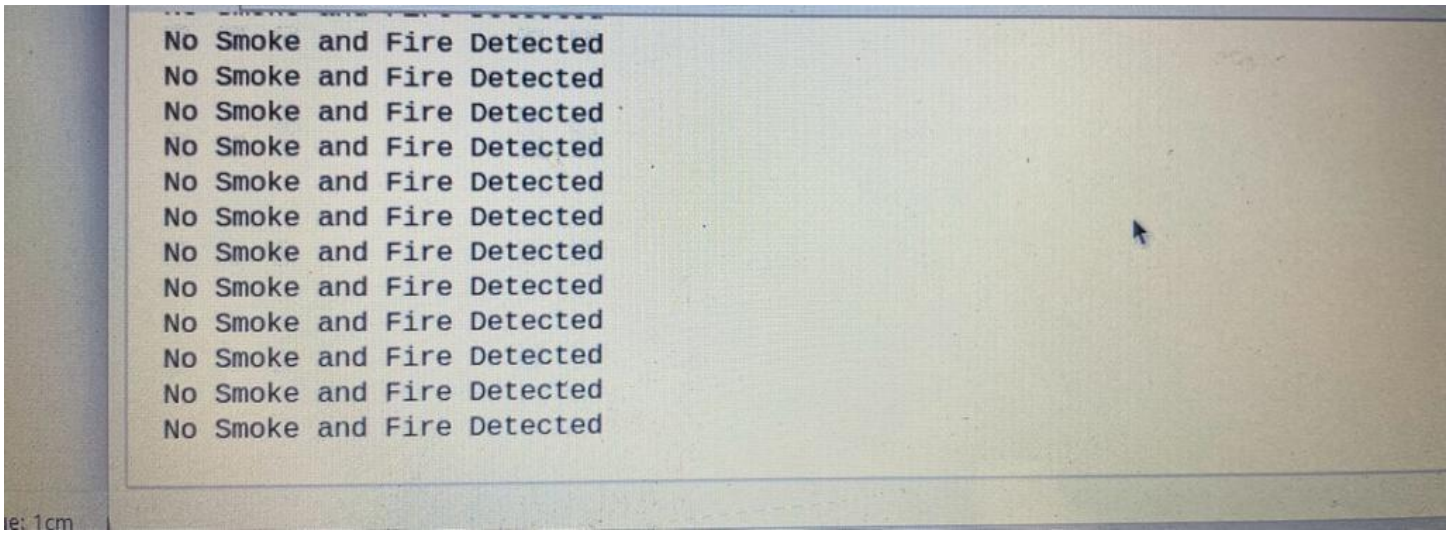


**Simulation Results: -**

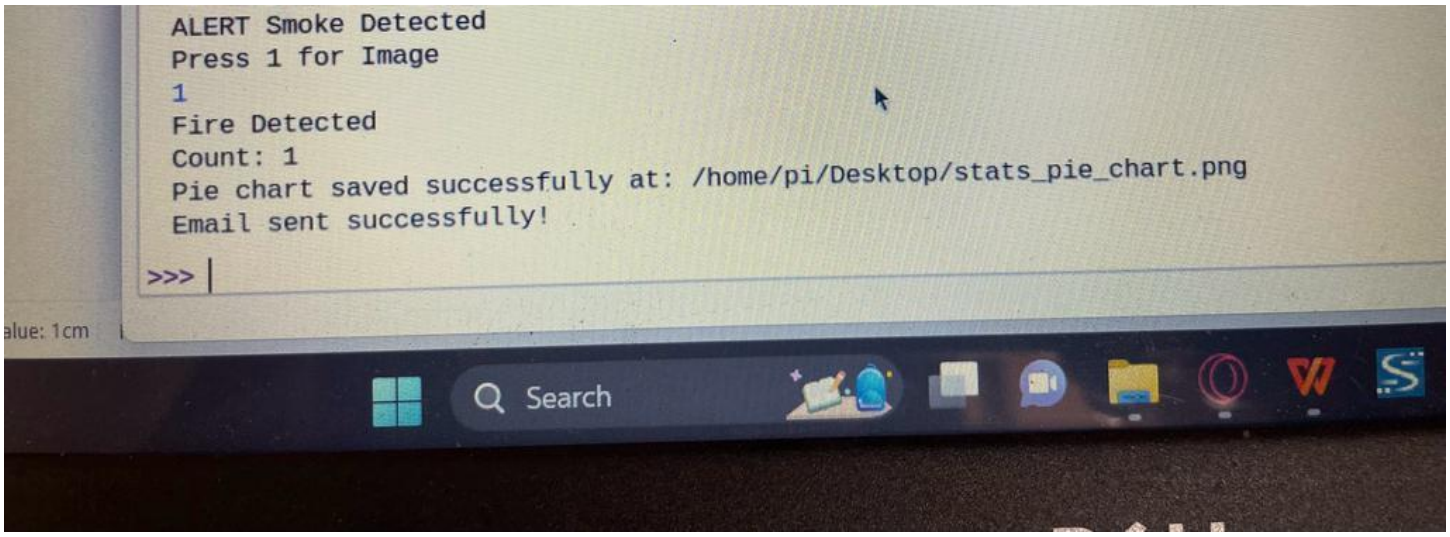


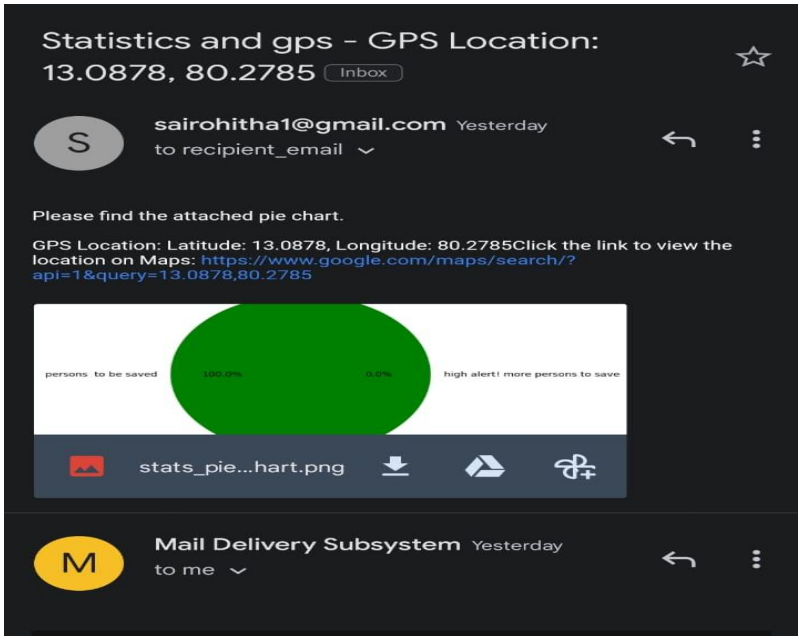

**Implementation / Prototyping Results: -**

**If NO Smoke and Fire Detected:**




**If Fire Detected:**






**Discussion & Conclusions: -**

The implementation of our fire detection system yielded promising results. The integration of image processing, machine learning, and hardware components provided an advanced solution for fire detection and suppression. The image processing algorithms accurately estimated the fire's size, while the machine learning model achieved high accuracy in distinguishing fire from non-fire scenarios. The integration of the Raspberry Pi, LCD screen, relay, and PCB enhanced the system's functionality and reliability. Our fire detection system, with its email notification feature and motor pump activation, offers a novel and effective approach to fire safety. It combines advanced technologies and innovative functionalities to detect fires promptly, estimate their size accurately, and enable immediate response actions. By continuously enhancing and expanding upon these capabilities, we can contribute to a safer environment and better protect lives and properties from the devastating effects of fire.